

IN THE CLAIMS:

Please amend claims 1, 7, 10 and 28; cancel claims 6 and 15; and claims 2-5, 8-9, 11-14, 16-27 and 29-41 remain unchanged. This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Currently Amended) A method for forming a silicon oxide layer over a substrate disposed in a high density plasma substrate processing chamber, said method comprising:

β^1 flowing a process gas into the substrate processing chamber, said process gas comprising a silicon-containing source, an oxygen-containing source and a fluorine-containing source;

forming a high density plasma from said process gas; and

heating the substrate to a temperature above 450°C during deposition of said silicon oxide layer, wherein said silicon oxide layer has a fluorine content of less than 1.0 at. %.

2. (Original) The method of claim 1 wherein the substrate is heated to a temperature above 500°C during deposition of said silicon oxide layer.

β^2 3. (Original) The method of claim 1 wherein the substrate is maintained at a temperature between 500-600°C during deposition of said silicon oxide layer.

4. (Original) The method of claim 1 wherein said silicon-containing gas is SiH_4 .

5. (Original) The method of claim 1 wherein said oxygen-containing source is O_2 .

6. CANCELED.

β^3 7. (Currently Amended) The method of claim 6 1 wherein said fluorine-containing source is either NF_3 or a fluorocarbon having a formula of $\text{C}_n\text{F}_{2n+2}$ where n is a positive integer.

β^4 8. (Original) The method of claim 7 wherein the plasma has an ion density of at least 1×10^{11} ions/cm³.

B4 9. (Original) The method of claim 1 wherein a flow ratio of said oxygen-containing source to said silicon-containing source is between 1.4-3.0:1 inclusive.

10. (Currently Amended) A method for forming a silicon oxide layer over a substrate disposed in a high density plasma substrate processing chamber, said method comprising:

- B3
- (a) flowing a first gas into the substrate processing chamber;
 - (b) forming a plasma having an ion density of at least 1×10^{11} ions/cm³ from said first gas and allowing said plasma to heat said substrate;
 - (c) thereafter, flowing a process gas comprising a silicon-containing source, an oxygen-containing source and a fluorine-containing source into said substrate processing chamber; and
 - (d) forming a plasma having an ion density of at least 1×10^{11} ions/cm³ from said process gas and allowing said plasma to heat said substrate to a temperature at or above 450°C during deposition of said silicon oxide layer wherein said silicon oxide layer has a fluorine content of less than 1.0 at. %.
-

11. (Original) The method of claim 10 wherein said oxygen-containing source is O₂ and said silicon-containing source is SiH₄.

B6 12. (Original) The method of claim 11 wherein said first gas comprises one or more of argon and O₂.

13. (Original) The method of claim 10 wherein said fluorine-containing source is either NF₃ or a gas having the formula of C_nF_{2n+2} where n is a positive integer.

14. (Original) The method of claim 13 wherein a flow ratio of said oxygen-containing source to said silicon-containing source is between 1.4-3.0:1 inclusive.

15. CANCELED.

16. (Original) The method of claim 10 wherein in (d) said plasma heats said substrate to a temperature of 500°C or more.

B7 17. (Original) A method for forming a silicon oxide layer over a substrate disposed in a high density plasma substrate processing chamber, said method comprising:

(a) flowing a first gas comprising at least one of an inert gas and O_2 into the substrate processing chamber;

(b) forming a plasma having an ion density of at least 1×10^{11} ions/cm³ from said first gas and allowing said plasma to heat said substrate;

(c) thereafter, depositing said silicon oxide layer by flowing a process gas comprising SiH_4 , O_2 and a fluorine-containing source into said substrate processing chamber while maintaining said plasma and allowing said plasma to heat said substrate to a temperature above 450°C during deposition of said silicon oxide layer;

wherein said silicon oxide layer has a fluorine concentration of 1.0 at. % or less.

B7 18. (Original) The method of claim 17 wherein said silicon oxide layer has a fluorine content of 0.6 at. % or less.

19. (Original) The method of claim 18 wherein a flow rate of said fluorine-containing source is greater than or equal to a flow rate of SiH_4 .

20. (Original) The method of claim 17 wherein said fluorine-containing source is NF_3 .

21. (Original) The method of claim 17 wherein said fluorine-containing source is a fluorocarbon having a formula of C_nF_{2n+2} where n is a positive integer.

22. (Original) The method of claim 17 wherein a flow ratio of said oxygen-containing source to said silicon-containing source is between 1.6-2.5:1 inclusive.

23. (Original) The method of claim 20 wherein a flow rate of NF_3 is between 50 150 sccm and a flow rate of SiH_4 is between 50-150 sccm.

24. (Original) The method of claim 23 wherein a flow rate of NF_3 is greater than or equal to a flow rate of SiH_4 .

B6 25. (Previously Added) The method of claim 1 wherein the silicon oxide layer is used as a premetal dielectric layer or part of a shallow trench isolation structure.

26. (Previously Added) The method of claim 10 wherein the silicon oxide layer is used as a premetal dielectric layer or part of a shallow trench isolation structure.

B8 27. (Previously Added) The method of claim 17 wherein the silicon oxide layer is used as a premetal dielectric layer or part of a shallow trench isolation structure.

28. (Currently Amended) A method for forming a silicon oxide layer over a substrate disposed in a high density substrate processing chamber, said method comprising:

flowing a process gas a silicon-containing source, an oxygen-containing source and a fluorine-containing source into the substrate processing chamber;

B9 forming a plasma having an ion density of at least 1×10^{11} ions/cm³ from said process gas; and

biasing the plasma during deposition of the silicon oxide layer to generate a sputter etching component simultaneous with film deposition, wherein the plasma heats the substrate to a temperature at or above 500°C during deposition of the silicon oxide layer and wherein said silicon oxide layer has a fluorine content of 1.0 at. % or less.

29. (Previously Added) The method of claim 28 wherein the sputtering element of the deposition process slows deposition on corners of raised surfaces the silicon oxide layer is deposited over thereby contributing to the increased gapfill capability of the silicon oxide layer.

30. (Previously Added) The method of claim 29 wherein the silicon oxide layer is used as a premetal dielectric layer or part of a shallow trench isolation structure.

B10 31. (Previously Added) The method of claim 30 wherein said silicon oxide layer has a fluorine content of 0.6 at. % or less.

32. (Previously Added) The method of claim 31 wherein said silicon-containing gas is SiH₄.

33. (Previously Added) The method of claim 32 wherein said oxygen-containing source is O₂.

34. (Previously Added) The method of claim 1 wherein the silicon oxide layer is doped with phosphorus and said process gas further comprises a phosphorus containing source.

35. (Previously Added) The method of claim 34 wherein said phosphorus containing source is PH_3 .

36. (Previously Added) The method of claim 10 wherein the silicon oxide layer is doped with phosphorus and said process gas further comprises a phosphorus containing source.

37. (Previously Added) The method of claim 36 wherein said phosphorus containing source is PH_3 .

38. (Previously Added) The method of claim 18 wherein the silicon oxide layer is doped with phosphorus and said process gas further comprises a phosphorus containing source.

39. (Previously Added) The method of claim 38 wherein said phosphorus containing source is PH_3 .

40. (Previously Added) The method of claim 31 wherein the silicon oxide layer is doped with phosphorus and said process gas further comprises a phosphorus containing source.

41. (Previously Added) The method of claim 40 wherein said phosphorus containing source is PH_3 .
